

OPERATIONAL ART – LEVERAGING INFORMATION TECHNOLOGY

A Monograph
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Second Term AY 99-00

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Title of Monograph: *Operational Art – Leveraging Information Technology*

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Accepted this 12th Day of May, 2000

ABSTRACT

OPERATIONAL ART – LEVERAGING INFORMATION TECHNOLOGY by
MAJ Tedd A. Wheeler, US Army, 61 pages.

The challenge is in deciding what to automate (effective use of technology) and what remains a human function. The 1999 US National Security Strategy emphasizes the importance of information technology. However, the decisive point of all future military operations will continue to be the men and women of the armed services. Achieving a proper balance between technology and people is critical to our nation's security. The goal of this research was to answer the research question: are there Information Technology Leverage Points within Operational Art? The research methodology has two phases. The research first defines a conceptual model using Senge's Systems Thinking theory. Senge has designed a blueprint for an organization where people expand their capacity to create results they truly desire, where new and expansive patterns of thinking are nurtured, and where collective aspiration is set free. Systems Thinking is a conceptual framework, a body of knowledge and tools that has been developed to make full patterns clearer, and to help us see how to change them effectively. Looking at Operational Art as a system provides an opportunity to analyze processes, decision points, and points of data input and output. This systems analysis allowed the researcher to apply his individual and battle staff (group) perspectives during multiple operational and tactical exercises throughout the Command and General Staff College (CGSC) and the School for Advanced Military Studies (SAMS) academic years.

The answer to the research question is yes there are information technology leverage points within operational art, but not as many as initially anticipated. Throughout the published works on the concept of decision support technology and the integration of information technology to help people make decisions, a common finding is that the human mind is an amazing tool. Through the use of intuition, mental models, and experience humans are able to sort through reasonable amounts of information to make a decision even with a complex problem. The operable word is reasonable amount of information. Information technology offers multiple mediums that can provide more information than the human mind is able to process. Today's staff has almost an unlimited amount of information at their disposal to offer to the commander in helping them to make decisions. The tendency in some staffs is to spend a lot of time gathering large amounts of data, but then not spending the time to first decide what is really important and then to synthesize the information into a reasonable amount of information to provide to the commander.

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CHAPTER I

INTRODUCTION

"The challenge is in deciding what to automate (effective use of technology) and what remains a human function."¹ In a recent forum at the US Army School for Advanced Military Studies (SAMS), retired Brigadier General Wass de Czege discussed future war and the challenge of designing a future force that has the right mix of high technology weapons, information systems, and people. The 1999 US National Security Strategy emphasizes the importance of information technology.² However, the decisive point of all future military operations will continue to be the men and women of the armed services. Achieving a proper balance between technology and people is critical to our nation's security. The insight above into the challenge of balancing technology and the human dimension highlights the importance of this research effort. The goal of this research is to answer the research question: are there Information Technology Leverage Points within Operational Art? This researcher's initial perspective was that there were multiple leverage points and the choice was only where to apply information technology. During the process of this research effort, the number of possible leverage points was reduced as this researchers understanding of integrating information technology to support operational art increased

The research methodology has two phases. The research first defines a conceptual model using Senge's Systems Thinking theory. Peter M. Senge is founder and Director of the Center for Organizational Learning at the Massachusetts Institute of Technology's (MIT's) Sloan School of Management. "Senge has designed a blueprint for an organization where people expand their capacity to create results they truly

desire, where new and expansive patterns of thinking are nurtured, and where collective aspiration is set free.”³ Systems Thinking is a conceptual framework, a body of knowledge and tools that has been developed to make full patterns clearer, and to help us see how to change them effectively.⁴ Looking at Operational Art as a system provides an opportunity to analyze processes, decision points, and points of data input and output. This systems analysis allows the researcher to apply his individual and battle staff (group) perspectives during multiple operational and tactical exercises throughout the Command and General Staff College (CGSC) and the School for Advanced Military Studies (SAMS) academic years.⁵

The second phase of this research is the application of Senge’s Leverage Point concept. “The bottom line of Systems Thinking is leverage – seeing where actions and change in structures can lead to significant, enduring improvements.”⁶ The concept of Leverage Points directs effort to change specific points within the system where small, but well focused actions result in economies of scale results. Too often leverage points are hidden to people within the system because they fail to see the underlying relationships and the second and third order effects within the system. This research attempts to frame Operational Art as a system then define points or processes within the system where the application of Information Technology offers opportunity for meaningful and lasting results.

Chapter II’s Doctrinal section reviews current Joint and US Army doctrine on Operational Art. Operational Art is the employment of military forces to attain strategic and/or operational objectives through the design, organization, integration, and conduct of strategies, campaigns, major operations, and battles.⁷ This research further

delineates the Operational Art system into two distinct yet interrelated characteristics: the art of command and science of control. The US Army published a content summary pamphlet for Field Manual 100-5, Operations that establishes the framework for their capstone manual (currently under revision).⁸ The art of command and the science of control framework provide a structure to apply the two types of Decision Support Technologies. Chapter II then introduces Decision Support Technology and discusses the two types of support systems (executive and group support systems).

Decision Support Technology is generally categorized into Executive Support Systems (ESS) or Group Support Systems (GSS).⁹ Chapter V defines Decision Support Technology and discusses the theoretical benefits of Decision Support Technology for military application: ability to examine more alternatives, gain a better understanding of the organization, respond quickly to unexpected situations, conduct "what if?" analysis, acquire insights into the operational level of war, and optimize the use of resources available.¹⁰ The highly complex and interrelated nature of Operational Art makes it difficult to define the commander and staff's information requirements or to develop a framework for managing information feeding Operational Art. The intent of this section is to define Decision Support Technology in a framework to be useful when analyzing information technology leverage points.

Chapter III first discusses the human dimension of operational art and establishes the art and science dimensions; this chapter then explores the two models of problem solving that supports each dimension (intuitive and analytical respectively). Secondly, Chapter III defines and explores the relationships between the two primary players within operational art: the commander and the staff. Chapter III then proposes

an Operational Art conceptual model, using Senge's Systems Theory. Appendix I, Operational Art – A Conceptual Model, is used as the baseline conceptual model for this research effort.¹¹ Appendix I is a work in progress of this author to better understand Operational Art as a system. This conceptual model provides a theoretical framework and allows this researcher to analyze the model for specific points to apply the leverage point concept.

Chapter IV (Subsystem One – “Vision”), Chapter V (Subsystem Two – “Means”, Chapter VI (Subsystem Three – “Objectives”), and Chapter VII (Subsystem Four – “Ways”) provide the forum to present the second phase of this research effort. Each chapter first defines the conceptual framework of each subsystem then identifies and discusses potential information technology leverage points. This researcher used time, purpose, and increased situational awareness as the criteria by which to evaluate proposed Operational Art leverage points. Time is defined in terms of reducing time to make a decision or to complete a process. “Speed is the essence of War.”¹² Purpose is defined as what military condition(s) must be produced in the operational area to achieve the strategic aim? Increased situational awareness is defined as when the commander or battle staff has a clearer understanding of the battlefield in respect to seeing themselves, the enemy and the environment. See yourself, see your enemy, and see the terrain.¹³

The analysis and presentation of these leverage points provide a baseline for additional research and study of the integration of information technology into the process of Operational Art. The results of this research effort will be beneficial to military commanders and staff who are required to bridge the gap between strategic

goals and objectives and tactical operations in an ever increasing environment of complexity and time constraints.

CHAPTER II

RESEARCH FOUNDATION

Clausewitz cautioned “not to take the first step without considering the last”; his insight into strategy has direct application in the essence of a having a good doctrine foundation operational art before practicing it.¹⁴ Chapter II, Research Foundations, first records current Joint and US Army doctrine on Operational Art. Operational Art in its practical essence is the management of time, resources, and risk in a dynamic environment to orchestrate temporally and spatially distributed operations into one coherent whole.¹⁵ It is a desirable skill for both commanders and battle staffs to be grounded in the doctrinal definition of Operational Art in order to free them from being bound by its dogma. The second section of Chapter II then introduces and discusses the two types of Decision Support Technology: Executive Support Systems (ESS) and Group Support Systems (GSS).

DOCTRINAL

US Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, defines operational art as “the employment of military forces to attain strategic and/or operational objectives through the design, organization, integration, and conduct of strategies, campaigns, major operations, and battles. Operational art translates the joint force commander’s strategy into operational design, and, ultimately, tactical action, by integrating the key activities at all levels of war.”¹⁶ This is not to imply that the commander goes back and changes the strategic objectives or guidance that has been provided to him by the National Command Authority (NCA). The joint force commander’s charge is to ensure that military operational objectives

support the achievement of strategic objectives and subsequently tactical actions support the achievement of military operational objectives.

Operational art defines the military conditions (military endstate) that when achieved accomplish a specified higher aim. The practical essence of operational art is then a system of interrelated processes of: sequencing actions within a timeframe to produce those military conditions, resourcing a force to accomplish the sequence of actions, and measuring the risk to the force in performing those actions. Risk is expressed in term of potential harm to a force because of an assigned set of tasks assigned. The commander has the responsibility to constantly decide when the risk to the force is too high and mission accomplishment is ultimately at risk. The feedback loop in the process can be to change the sequencing of action or resources given to the force.

US Joint Publication 3-0, *Doctrine for Joint Operations*, provides a list of facets of Operational Art: synergy, simultaneity and depth, anticipation, balance, leverage, timing and tempo, operational reach and approach, forces and function, arranging operations, centers of gravity, direct versus indirect, decisive points, culmination, and termination.¹⁷ For the purpose of this research, centers of gravity, decisive points, operational reach (lines of operations), and arranging operations (phases and branches and sequels) will be addressed.

“Centers of gravity are those characteristics, capabilities, or localities from which a military force derives its freedom of action, physical strength, or will to fight.”¹⁸ The concept of centers of gravity assists to provide focus during both planning and execution of military operations. The concept of centers of gravity has application in

defining capabilities and limitations of both friendly and enemy forces. Decisive points are directly related to centers of gravity in that they provide a linkage framework.

"Decisive points are not centers of gravity; they are the keys to attacking protected centers of gravity."¹⁹ Centers of gravity and decisive points provide a framework for analyzing both the friendly and enemy situations. This framework provides a means to thinking about how to protect friendly centers of gravity and to attack enemy centers of gravity.

One of the main ideas within the operational reach concept is the term lines of operation. "Lines of operations are lines, which define the directional orientation of the force in time and space in relation to the enemy. They connect the force with its base of operations and its objectives."²⁰ Lines of operations provide a three dimensional framework to think about and analyze the physical geometry of moving friendly forces from a base of operations within an area of operations and to objectives. Lines of operations can be categorized as interior or exterior lines of operations. Interior lines of operation converge toward an enemy or objective from a central point and provide for flexibility. This flexibility allows forces or resources to be shifted laterally and benefits a weaker force. Exterior lines converge upon an enemy and provide more opportunities to encircle the enemy or objective; however, exterior lines normally require a stronger force. Within the concept of arranging operations are the notions of phases, branches, and sequels.

"A phase represents a period during which a large portion of the forces are involved in similar or mutually supporting activities phase may be for deterrence or to seek to set the terms for battle and enhance friendly and limit enemy freedom of

action.”²¹ The facet of phasing provides a framework to synchronize the employment of friendly forces across the area of operations. Phases may be sequential or may overlap; however, the transition between phases should be distinct in order to focus and synchronize effort.

The notion that no plan can predict exactly how the enemy will react or significant changes in the environment require that options to deal with changes to the initial plan. “Branches are options built into the basic plan. Sequels are subsequent operations based on the outcomes of current operations.”²² Branches and sequels provide a framework of options based upon the premise that no plan is absolute. Enemy forces may act or react in a manner that was not anticipated or friendly units may fail to achieve an assigned objective. The proper use of branches and sequels provide a commander with options aligned with the phases of the operation by shifting forces, priorities of effort (use of branches), or even changing the nature of the operation (use of sequels).

Is operational art an art or a science? The answer to the question is both; an artist creates while a scientist analyzes. While these two aspects of operational art appear dipolar in function, they actually prove to be complimentary in practice. Within a military context, who performs what role? The burden of scientific analysis falls primarily on the staff officer. This group of people ultimately forms the fuel for the grand design of the artist.²³

US Joint doctrine does not provide an operational art conceptual model. The US Army recently published a content summary pamphlet for Field Manual 100-5, *Operations*, (currently under revision) that establishes the framework for their capstone

manual. The pamphlet contains a theoretical framework (see Appendix II) titled "Art of Command and the Science of Control."²⁴ The Field Manual 100-5 writing team has attempted to develop a conceptual model for the combination of the art and the science of visualizing, describing, and controlling military operations (operational art). The theoretical framework assigns the artist role to the commander and the scientist role to the staff.

"FM 100-5 must provide doctrinal direction that enables commanders to visualize, describe, and direct land operations. These three critical components of battle command combine military art and science. The ability of commanders to visualize their battle space in terms of time, space, combat power, and purpose is the essence of the art of battle command. Translating vision to action combines art and science in the plan, prepare, and execute phases of an operation to accomplish the mission."²⁵

Appendix II depicts operational art as a seemingly sequential process where the commander visualizes and describes (the Art of Command) the battle space by using the commander's estimate process. The staff then assists the commander to direct force by using the staff estimate process. The majority of the model and supporting text attempts to provide a framework for the commander to visualize and describe his battle space. There is less depiction and discussion of the staff's estimate process and how the staff works in concert with the commander to assist him in directing the application of military force. The intent in introducing the US Army's current and emerging attempt to depict a theoretical framework is not to dispute it. The intent is only to document the current effort. Because the US Army Field Manual 100-5 doctrine is still emerging and not yet accepted as doctrine, this researcher proposes a conceptual model to use as a

baseline model in Chapter IV. The art of command and the science of control framework provide a model to apply two types of Decision Support Technologies.

DECISION SUPPORT TECHNOLOGY

Decision Support Technology is generally categorized into Executive Support Systems (ESS) or Group Support Systems (GSS). The highly complex and interrelated nature of Operational Art makes it difficult, but not impossible to define the commander and staff's information requirements or to develop a framework for managing information feeding operational art. The intent of this chapter is to define decision support technology in a framework to be useful when analyzing information technology leverage points.

US Joint and Army doctrine does not define decision support systems. Current business research generally defines a decision support system as any tool that provides a mechanism to make decisions in a faster and more efficient manner. Defined as a system, decision support systems consist of four primary elements: information, process, technology, and organizations/people.²⁶ The US Army operations research community views the support of decision making through the use of computers or any analytical method as a decision support system.²⁷ This research defines the theoretical benefits of decision support technology for military application as: the ability to examine more alternatives, gain a better understanding of the organization, respond quickly to unexpected situations, conduct "what if?" analysis, acquire insights into the operational level of war, and optimize the use of resources available. Executive support systems, for the purpose of this research, are tools created specifically to aid the commander in the decision making process or for

individual staff members who provide information to the commander to assist them in the decision making process. Group support systems are created to aid the staff in their process of analysis in order to bring information to the commander to make a decision.

Van Creveld states "... present day military forces, for all the imposing array of electronic gadgetry at their disposal, give no evidence whatsoever of being more capable of dealing with information needed for the command process than were their predecessors a century or even a millennium ago."²⁸ His thesis is an interesting counter-argument as the US Army struggles with defining information dominance; a term yet to be defined by US Joint or Army doctrine. Current trends in the US Army's Force XXI modernization planning discusses information dominance as the use of information to overwhelm an opponent and provided a mechanism for achieving military objectives.²⁹ However, Van Creveld posits in this instance that people (commanders) are the constraining factor in the decision making process. Yet much of the focus of where the US Army is driving their future force is to give the commander more information as to assume they can make faster and more efficient decisions.

The staggering amounts of raw data available to the US military are growing exponentially in this information revolution age. A simple search for decision support technology on the World Wide Web (WWW) yields 10,500 results. The challenge for using information technology is not the whether to use it or not; the challenge is where and how to use it. As noted above, two of the primary elements of a decision support system are information and people. How people are able to retrieve and use information to help them make decisions is critical. Understanding the process (the

third primary element) requires looking at the process as a system and breaking it down to interrelated subsystems. Technology (the fourth primary element) is relatively unbound in application within a system.

Human capability sets the bounds in a system that attempts to provide an ever-increasing amount of information.³⁰ Operational art's domain is in the realm of the complex and ever shifting conditions; thus, is it practical to propose that information technology can be used as a tool to aid a commander in making decisions. The commander practices the art aspect of operational art in attempting to define the problem in military terms (as defined to him in strategic terms), describe the needed military conditions to achieve the strategic objective, then set in motion the tactical actions that will accomplish military objectives. Is it practical that an artistic process can be aided by information technology? Or would technology be better used to support a commander's staff in analyzing information and bringing options to the commander for a decision?

The next chapter, Operational Art – A Conceptual Model, will explore the human dimension of making decisions and how the decision making process is the critical link between pre-defined processes, free form processes, and feedback loops together to form an amazing system. In order to be able to analyze operational art for leverage points, this research has divided the conceptual model into four subsystems. The conceptual model uses commonly accepted business process symbols to describe activities; each activity is labeled for analysis purposes. See Appendix I for the key to each business process symbol.

CHAPTER III

OPERATIONAL ART – A CONCEPTUAL MODEL

Chapter II of this research provided the doctrinal foundation of operational art and introduced its two characteristics: art and science. Chapter III further develops the human dimensions of operational art and then proposes an operational art conceptual model. This conceptual model will be used in the second phase of this research to analyze operational art as a system and identify leverage points. Senge's Systems Theory and Leverage Point concept was previously defined; the concept of mental models is introduced and discussed in this chapter. Dr. Gary Klein's Recognition-Primed Decision Model (RPDM) is first introduced to establish the behavioral characteristics of how people make decisions. As noted in above, one of the primary elements of a decision support system is process. Operational art is a series of interrelated processes connected by decisions that a commander must make. The commander's staff assists him or her in making decisions by providing group analysis with insight and expertise that the commander may or may not possess. However, it is ultimately the commander who must make decisions and move the process on to the next stage.

HUMAN DYNAMICS

In his book, Sources of Power: How People Make Decisions, Dr. Gary Klein introduced a behavioral model titled the Recognition-Primed Decision Model.³¹ In his model Klein, a leading cognitive psychologist in the field of behavioral science, posits that experience allows decision makers to see a situation, even a non-routine one, as an example of a prototype, thus they know the typical course of action immediately.

Klein calls it intuition; Clausewitz called it coup d'oeil or a glance of the inner eye.³² Coup d'oeil in its practical essence is a quick recognition of the truth where the mind would ordinarily miss the cue, or would require long study or reflection to see the truth. The power of intuition is intrinsically linked to the level of experience; experience is used to recognize key patterns that indicate the dynamics of the situation. Klein posits that intuition grows from experience and allows a person to make decisions seemingly without the cognitive tension.³³ Out of experience grows intuition, but so do mental models.

Behavioral scientists have written extensively about how mental models are developed from learned experiences and grow into intuition. The same scientists conversely propose that mental models can become negative when the model is no longer valid, yet continues to guide thoughts and decisions. Senge discussed mental models and both their positive and negative affect upon viewing an issue and solving problems. Mental models are deeply engrained assumptions, generalizations, or even pictures or images that influence our worldview and our actions.³⁴ Mental models are part of human nature and require significant effort to ensure the models one uses remain valid.

The classical military argument is how to approach solving about a problem. One method is the classical analytical decision making model; another method is the intuitive model.³⁵ A key variable in using one or the other model is experience. Experience in this context is defined as having practical application in military planning and executing military operations. Insight and intuition into solving problems is gained through experience and practice; the more experience and practice a decision maker

has, the better developed their intuition tends to be. The US military tends to use the analytical decision-making model to solve problems at the tactical level of war where the military mission is provided and the problem is relatively simple.³⁶ US Army Field Manual 101-5, Staff Organizations and Operations, provides a time tested analytical approach to decision making titled the Military Decision Making Process (MDMP). Tactical commanders and staffs with a balanced level of experience and who are well grounded in doctrine are able to free themselves from being bound to a strict adherence to the very analytical US Army decision making model.

Commanders and staff without a balanced level of experience and/or those not well grounded in doctrine, often find themselves mired in a very detailed analytical process (even with a fairly simple problem). This type of organization conducts a very analytical process to avert risk.³⁷ The staff is required to present multiple courses of action for the commander's decision because the staff may be inexperienced or an inexperienced commander may need to sort through several options to help him decide the best method of action. An argument against using the Military Decision Making Process at the operational level of war is that the problem and operating environment has become so complex that the analytical process becomes unmanageable.³⁸ Operational Art was defined earlier as the process of linking tactical actions to strategic goals by developing operational design. Staffs operating at the operational level of war tend to be a more mature staff in levels of experience. However, that theory continues to be tested during recent support and stability operations the military is currently involved in. Current operations in Bosnia require a US Army division to operate at the

operational level of war. Current operations in Kosovo require a US Army brigade to perform operational art.

The variable of experience was discussed earlier in this chapter and tends to determine the decision-making model used. The typical US military structure of a commander and staff takes advantage of and provides a balance to different types and levels of experience.

The goal of the command-staff process must be to assist the commander in making correct decisions in time. The ability to act faster than the enemy, to gain agility over an opponent, is largely dependent upon rapid and correctly timed human decisions. In war, commanders and staffs must be experts at using all the available tools to accomplish operational art.³⁹

The commander's primary role is to make decisions. Decisive action is imperative in war and decisive action requires clear and succinct orders. In past practice the commander's role was to choose between options that his staff would present to him at briefings.⁴⁰ Too often, the quality of the commander's decisions was framed by his staff's ability to analyze a problem. Recent trends in doctrine and technique across us military services define a more active role for the commander.⁴¹ The strain of information dominance and advances in real-time information require a commander to be more integrated in the staff's planning process with the potential to accelerate and optimize the decision making process.

CONCEPTUAL FRAMEWORK OVERVIEW

Appendix I, Operational Art - A Conceptual Model (see appendix I), is this researcher's effort to self visualizing operational art and for conveying the process to others.⁴² Depicting operational art as a system provides a means to break it down into subsystems and attempt to explain relationships between subsystems. The behavioral framework of decision-making was outlined above and the person responsible for making decisions within operational art is the commander. The main theme woven throughout this conceptual model is to depict a system that helps the commander to make sound and timely decisions. This research names the dominant player (commander or staff) within each subsystem and characterizes the subsystem as either art or science. This differentiation is primarily to establish what type of decision support system could be applied at a defined leverage point. Chapter II's Decision Support Technology section defined Executive and Group Support Systems (ESS and GSS).

The conceptual model consists of a doctrinal foundation and four interrelated subsystems. The doctrinal foundation is a series of questions the commander must resolve in thinking through a problem.⁴³ These series of questions serve to summarize critical aspects of the entire conceptual model. Subsystem one is categorized as art with the commander as the dominant player; this subsystem is a process to define the military conditions ("Vision") of the operation. Subsystem Two ("Means") is categorized as science with the staff as the dominant player; this subsystem is an iterative estimate process that assists the commander to visualize the enemy, the environment, and friendly forces. The commander also completes an estimate, but relies upon the staff for the detailed analysis and presentation of critical information. Subsystem Three ("Objectives") is categorized as art with the commander as the dominant player; this

subsystem is a process to define the operational objectives that will subsequently be translated into tactical actions. Subsystem Four ("Ways") is categorized as science with the staff as the dominant player; this subsystem defines the operational framework of achieving defined military objectives. Chapter III discussed three key concepts: the decision making process, the intuitive and analytical problem solving models, and the roles and relationships between the commander and staff. These concepts will be used as discussion points in defining each subsystem in order to propose leverage points where information technology could be used.

CHAPTER IV

SUBSYSTEM ONE – “VISION”

In 1982 Thomas Peters and Robert Waterman, two successful business management practitioners turned authors, wrote the book In Search of Excellence. Their book was widely acclaimed in the business management community as a successful “how to” manual that struck a balance between theory and practice. In the first chapter, Successful American Companies, they introduce eight characteristics of successful companies and discuss how not one company is able to do all eight characteristics well all the time. There was however one characteristics that successful companies always seemed to get right. These companies developed a strategy that focused on execution and continuous adaptation; they got things done yet remained flexible.⁴⁴ Because of the complexity of the problem and the ever-changing environment, operational art requires the military application of Peters and Waterman’s strategy framework. Subsystem One (see figure 1) of the operational art conceptual model is categorized as art with the commander as the dominant player; this subsystem is a process to define the military conditions (“Vision”) of the strategic problem. The definitions of the business process symbols are noted in the key of Appendix I.

STRATEGIC FRAMEWORK

The receipt of some form of strategic guidance, mission, objective, or problem (activity 1-1) initiates the process within subsystem one. The second activity (1-2) within the “Vision” subsystem is a decision point.

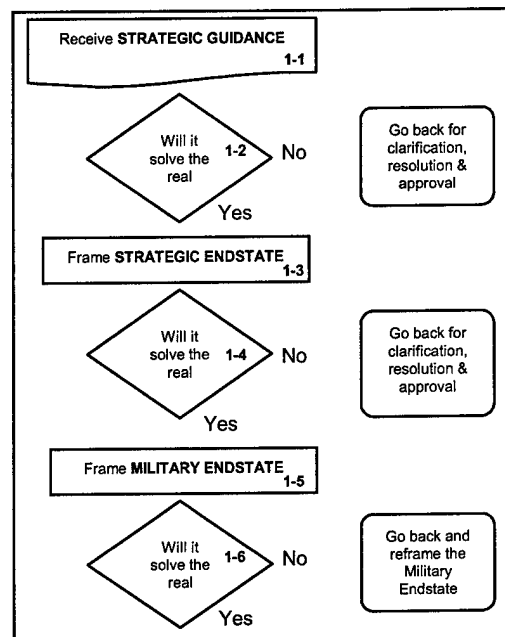


Figure 1: Subsystem One "Vision"

The commander must determine if the strategic guidance will solve the real problem or if the effort is focused on a symptom of the real problem. If the strategic guidance will not solve the real problem ("no" answer), it is imperative that the commander goes back and gets clarification (feedback loop), resolution and approval to move forward ("yes" answer).

The third activity in the "Vision" subsystem is to frame the strategic endstate (1-3). The strategic endstate by US Joint doctrine is to be specified by the US National Command Authority (NCA) before the military is committed.⁴⁵ However, in practice defined strategic endstate guidance is not always provided because of the complexity of the problem or unclear political objectives. Lack of a strategic endstate may require the commander to describe in measurable or quantifiable terms what the strategic endstate is and get approval of the interpretation from the National Command Authority. Once

again the commander must evaluate if the strategic endstate will solve the real problem (activity 1-4). As specified above in activity 1-2, the commander has a feedback loop to resolve any issues before moving forward to activity 1-4 (framing the military endstate). Framing the military endstate (activity 1-5) is the critical translation of strategic endstate into measurable or quantifiable military terms and considered the first steps in the estimate and planning processes.⁴⁶

Achieving the military endstate alone will seldom achieve the strategic endstate. It is imperative to understand the military conditions where the predominant national instrument of power shifts from the use of the military to another instrument. As noted above, framing the military endstate is the initiation and linkage to subsystem two (estimates). Again as noted above, activity 1-6 is another decision point where the commander must assess if the military endstate will help to solve the military aspect of the real problem. This decision point differs from the first two decision points in that the feedback loop is internal and provides the commander an opportunity to validate linkage through the strategic guidance issued in activity 1-1. Even though the commander is the dominant player in the "Vision" subsystem, the staff has a support role to assist in defining the military endstate. Depending on the experience of the commander, a few key staff members or possibly a large group may be involved with the commander in the translation of strategic guidance to military endstate. When required, the commander can use the staff to think artistically about the problem. The commander may use their specialty areas of expertise and intuition to develop aspects of the military endstate that the he or she may not have insight into.

INFORMATION TECHNOLOGY LEVERAGE POINTS

As noted in the introduction of this research effort, the hardest choice to make is what to automate (the application of some form of information technology) and what remains a human functions. The "Vision" subsystem is inherently an artistic process with an experienced player (the commander) playing the dominant role. The receipt of some form of strategic guidance (activity 1-1) and framing of the strategic endstate (activity 1-2) are by US Joint Publication 3.0 the responsibility of the US National Command Authority, but experience shows that the strategic guidance is often vague or seemingly non descriptive in military terms because of the complexity of the problem. The strategic guidance will also normally be framed in Diplomatic, Informational, Military, and Economical (DIME) terms and if required, the commander will decide where military national power can help solve the problem.

The key leverage point within the "Vision" subsystem is to understand the real problem. All three decision points repeatedly ask the same question "will it solve the real problem?" The leverage point is not the decision making process; it is the information that is required to make the decision. In the traditional military role of warfighting, the enemy or belligerent was the problem, but in the emerging role of operations other than war the problem becomes more complex and harder to understand. There is not a military or civilian information technology tool available that replaces the decision making process. There are multiple tools available to provide information to the commander and staff to help them in trying to understand the real problem, but the commander is ultimately responsible for making the decision and moving the process to the next activity. Personal computers, multimedia CD-ROM software, high capacity cable television, wired and wireless telephone networks, and the

Internet offer more mediums of information that can possibly be accessed, read, or comprehended with an environment of unlimited time. What is needed is a method to quickly search, access, and review information that is not in the commander or staff's knowledge base.⁴⁷

Time is most often always the resource that is constrained and requires the commander to use intuition as the primary mental model in understanding the real problem and what information that he or she can access, read and comprehend (possibly provided by their staff) in order to understand and articulate the real problem to others.

CHAPTER V

SUBSYSTEM TWO – “MEANS”

The “Vision” subsystem results in the definition of a military endstate that defines conditions required to support the accomplishment of the strategic endstate.

Depending on the commander and the situation, the staff may or may not have been involved in assisting the commander to develop the military endstate. Sun Tzu posits that if an estimate conducted in the safety of one’s temple before hostilities indicates victory it is because the calculations show one’s strength to be superior to that of his enemy; if they indicate defeat, it is because calculations show that one is inferior. “With many calculations, one can win; with few one cannot.”⁴⁸ Subsystem two, “Means” (see figure 2) is categorized as science with the staff as the dominant player; this subsystem is an iterative estimate process that assists the commander to visualize the enemy, the environment, and friendly forces and ultimately the problem. The definitions of the business process symbols are noted in the key of Appendix I.

CONCEPTUAL FRAMEWORK

Subsystem two or the estimate process begins an iterative process of attempting to understand the current friendly situation (activity 2-1), environment (activity 2-2), and enemy situation (activity 2-3). These three predefined processes are not listed in a prescribed order. The commander also completes an estimate, but relies upon the staff for the detailed analysis and presentation of critical information.

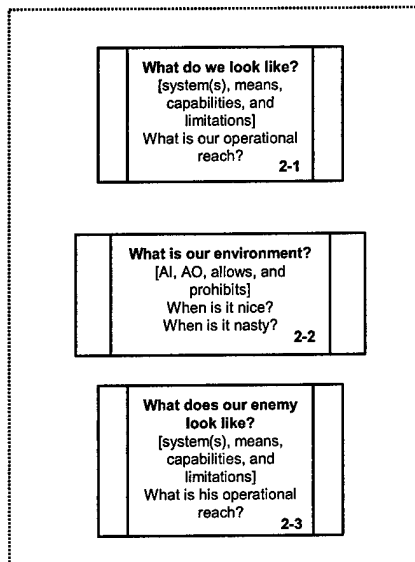


Figure 2: Subsystem Two "Means"

Even though this subsystem is analytical in nature as the problem is broken up into "bite size pieces" (friendly, enemy, and environment), it is critical that once the analysis is completed the pieces are put back together into a system called the problem. Once the analysis is completed, an experienced staff reassembles the detailed staff work and attempts to see the whole again with new insight into the problem. An inexperienced staff assembles all the pieces and presents the detailed analysis to the commander for them to discern the problem. Senge presents the metaphor of being able to step back from a situation and see the forest from the trees. Unfortunately, for most people when they step back, all they see is lots of trees.⁴⁹

Estimates should be developed in detail (at least one complete iteration) before Subsystem Three, "Ends" B, can be initiated. Estimates must be developed as comprehensively as possible and updated continuously to provide the commander with a relevant and timely picture of the problem. The complexity of the operational level of

war and fluid environment demands that estimates are continually updated to validate both facts and assumptions concerning the problem. Estimates not only provide a linkage to subsystem four (developing the "Ways"), but they also provide a tool to connect current operations with future operations (activity 4-7 of subsystem four – framing branches and sequels).⁵⁰ Once the staff has helped the commander visualize the situation, the commander can begin to translate the military endstate into operational objectives (Subsystem "Objectives").

INFORMATION TECHNOLOGY LEVERAGE POINTS

The analytical character of subsystem "Means" provides three natural leverage points as the staff breaks the problem up into pieces in an attempt to understand themselves and the enemy, and the environment. All three leverage points provide a means to gather detailed information about each aspect of the problem. As was noted in "Vision" subsystem leverage point analysis, what is needed is a mechanism to search, access, and review information on organizations (both friendly and enemy) and for the environmental conditions.

The US Department of Defense has increased the daily access of Joint doctrine by publishing an easy to use doctrinal index on the Internet and CD-ROM. All military services have brought their doctrine online in order to increase the knowledge base of anyone with access to the Internet. Understanding the doctrinal foundations provides a mechanism to increase the general understanding of the doctrine and allow greater freedom in its application. It is common practice for most US military organizations to produce a CD-ROM with capability briefs of their unit in attempt to not only market their capabilities, but increase the understanding of what missions the organization they are

not organized to perform. The primary issue with acquiring this type of organizational information is that it has not been consolidated for ease of access online or on CD-ROM or standardized in presentation format for ease of review. Information technology provides an unlimited resource of information to feed activity 2-1 (estimate of the friendly situation) and activity 2-3 (estimate of the enemy situation), but still needs to be organized for easier access and simpler search functionality. Too often the staff gets swamped wading through poor search results on the Internet and technology actually increases the time to conduct the estimate as opposed to reducing it.

The US Marine Corps has developed an indexed CD-ROM with web-based links that they provide to their Marine Air-Ground Task Forces.⁵¹ Digital maps, geographic data, and common digital maps within the US Army's Maneuver Control System (MCS) provide a great opportunity to increase situational awareness amongst the commander and staff as well as subordinate units.⁵² Digital resources accessed online, on a CD-ROM, or embedded in software can be easily packaged and integrated into briefings to help the commander visualize the environment. Products such as the US Engineer School's TerraBasell II offer a fairly easy to use software program that can be loaded on laptop computers. Digital maps and Digital Terrain Elevation Data (DTED) provide a to scale visualization of the operating environment.⁵³ The Maneuver Control System provides an onscreen visualization of the terrain with the ability to apply common overlays.

CHAPTER VI

SUBSYSTEM THREE – “OBJECTIVES”

In the business community, a vision has two vital functions. One is to serve as a source of inspiration and the other is to guide decision making, aligning all the organization's parts so they work together for a desired goal.⁵⁴ As noted in Chapter V the first iteration of the estimate process must be completed before Subsystem Three, “Objectives” should be initiated. The desired outcome from the detailed estimate analysis is a better vision of the problem. The next step in the process is to take this enhanced understanding of the problem with the military endstate of what conditions must be accomplished and focus effort on achievable objectives. Subsystem three is categorized as art with the commander as the dominant player with significant involvement from the staff; this subsystem is a continuation of subsystem one in defining the military ends of the problems, but in terms of operational objectives that will subsequently translated into tactical actions. The definitions of the business process symbols are noted in the key of Appendix I.

CONCEPTUAL FRAMEWORK

Subsystem three or framing operational “Objectives” is intrinsically linked to the estimate process as emphasized in Chapter V. Activity 3-1 within subsystem three is to frame the friendly centers of gravity and decisive points and develop methods to protect them from enemy attack. Centers of gravity and decisive points were defined and discussed in Chapter II, Doctrinal Foundations.

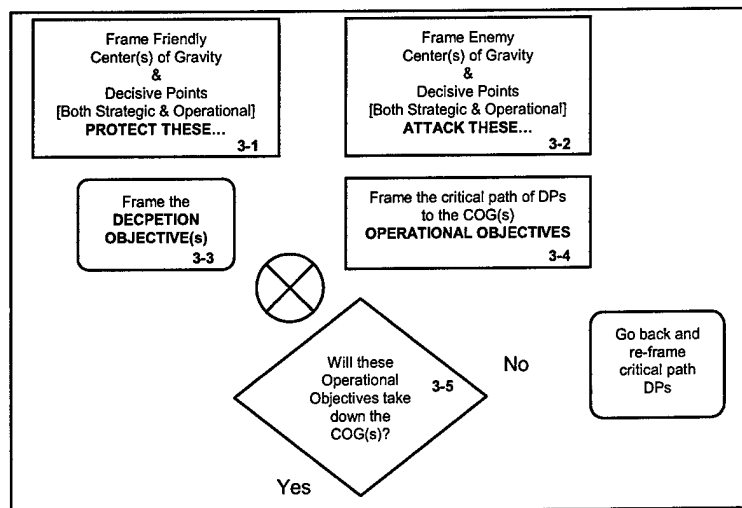


Figure 3: Subsystem Three "Objectives"

The more comprehensive the staff analyses the friendly situation (activity 2-1), the better the commander is able to describe his own centers of gravity and decisive points. Activity 3-3 of subsystem three is the process of framing deception objectives. Deception can be linked to protecting friendly centers of gravity and decisive points or to mislead the enemy as to the intent of attacking their centers of gravity or decisive points.⁵⁵ Activity 3-4 is the process of visualizing the path to attacking the critical decisive points that ultimately allow the enemy's center of gravity to be destroyed or obtained (mission dependent). After activities 3-3 (deception objective) and 3-4 (operational objectives) have been framed, the commander must ensure that the two objectives are synchronized. The deception objective must support the overall operational objectives and not cause wasted effort or confusion as to the intent of the mission.

Activity 3-5 is a decision point that asks if the chosen operational objectives will allow the enemy's center of gravity to be destroyed or obtained. The commander has

an internal feedback loop that provides an opportunity to validate the linkage from operational objectives back through the initial strategic guidance. If the commander answers "yes", the process continues into subsystem four where the staff as the dominant player proposes the "Ways" of the operation for the commander to decide what course of action will best achieve specified operational objectives.

INFORMATION TECHNOLOGY LEVERAGE POINTS

In an effort to develop a strategic information management plan, the Baltimore District Corps of Engineers (a 1,500 person Department of the Army public works organization) needed to rethink how they used information technology to perform work for both internal and external customers.⁵⁶ The District Engineer formed a small steering team that would eventually grow into the action team that would not only write the plan within six months, but also gain consensus from key leaders during the writing process. The primary concern for the team leader was to first ensure the key leaders understood that there was a problem, secondly understand what the problem was, and third to understand the direction that the strategic information plan would guide the district toward. Individual visits with each key leader would require too much time and inevitably result in multiple versions of the problem with varying solutions.

The team leader contracted a group decision support facility and arranged a one-day offsite work session with the goal of a common understanding of the problem at the end of the day. The facility used a group decision system that allowed each key leader to anonymously enter their version of the problem on a computer and simultaneously share it with the entire group. The facilitator then guided the group discussion using a wide screen projection of the groups input to lead them to a common

understanding of the problem. For many of the key leaders this was their first exposure to group decision technology and how technology could be used to help build consensus. The result for the team leader was a common understanding of the problem that a plan that proposed the direction the district would pursue over the next ten years to better serve customers.

Framing friendly and enemy centers of gravity and decisive points (activities 3-1 and 3-2) offer a leverage point where a group support technology system could both decrease time and increase situational awareness. As noted above, the dominant player within the "Objectives" subsystem is the commander in that they must ultimately frame the operational objectives. However, the processes of framing friendly and enemy centers of gravity and decisive points is primarily conducted by the staff and presented to the commander for approval or modification. The concepts of centers of gravity and decisive point provide a method to focus planning and operational effort in a time and resource constrained environment. It is imperative before operational objectives are formed that the commander and the staff have a common understanding of the problem (enemy center of gravity) and the path to ultimately achieving the stated military endstate.

During the process of this research effort many software program simulation resources were discovered that claimed to be able to model or wargame tactical actions between two forces. However, none attempted to simulate the complexity that the operational level of war requires where a commander is required to focus military power at objectives against a complex enemy in an ever-changing environment.

Chapter VI, the "Objectives" Subsystem completes the process of framing operational objective and provides a transition for the staff to begin Subsystem Four, framing the "Ways" of achieving the defined operational objectives.

CHAPTER VII

SUBSYSTEM FOUR – “WAYS”

“The principles of war, not merely one principle, can be condensed into a single word-‘concentration’. But for truth this needs to be amplified as the ‘concentration of strength’ against weaknesses. And for any real value it needs to be explained that the concentration of strength against weakness depends on the dispersion of your opponent’s strength, which in turn is produced by a distribution of your own that gives the appearance, and partial effect of dispersion. Your dispersion, his dispersion, your concentration-such is the sequence, and each is a sequel. True concentration is the fruit of calculated dispersion.”⁵⁷

In his classic book on strategy, BH Liddell Hart was attempting to summarize the difficulty in using principles and models to describe the linkage between strategy and tactics. Subsystem Four, framing the “Ways”, is the process of framing the physical geometry of the achieving the defined operational objectives discussed in Chapter VI. The “Ways” subsystem is categorized as science with the staff as the dominant player. The definitions of the business process symbols are noted in the key of Appendix I.

CONCEPTUAL FRAMEWORK

Subsystem four begins with the staff designing (via a physical time and space analysis) a single or multiple courses of action (time dependent). Through a series of activities, the staff provides the commander with options for defining the geometry of solving the problem. Additionally, the staff is required to continuously update their estimates (Subsystem Two) to validate all planning assumptions and assessments of potential “means” to achieve operational objectives and attack or obtain the enemy’s center(s) of gravity.

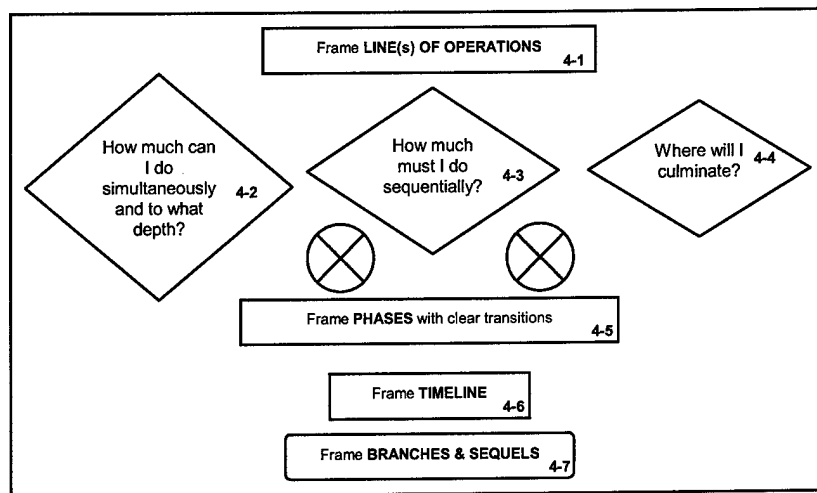


Figure 4: Subsystem Four "Ways"

Activity 4-1 of subsystem four is the process of framing lines of operation. Lines of operations orient the force in time and space and connect the force from its base of operations to its objective.⁵⁸ Depicting lines of operation provide the staff with a mechanism to analyze time and space as the force moves from its base of operations through its objective and establishes a framework to develop phasing (activity 4-5).

Activities 4-2, 4-3, and 4-4 are all decision points that require the staff to make analytical decisions that will help them to frame the phasing (activity 4-5) and timeline (activity 4-6). Activity 4-2 asks the questions "how much of the operation can be done simultaneously?"; activity 4-3 asks, "how much must I do sequentially?" Asking these questions provide a mechanism to assist the staff in attempting to optimally arrange the force over time and space. Activity 4-4 asks, "where will I culminate?" This question helps the staff to analyze where and when will the force run out of resources and no longer be able to maintain the initiative. The staff will once again revisit Subsystem Two ("Means") to revalidate their planning assumptions as well as to update the

assessment of their own forces, enemy forces, and the affect the environment has on their operations. After each of the three decisions is determined, a coordination point requires the staff to synthesize the answers and begin activity 4-5 (frame phasing). Framing phases with clear transitions provides the staff an understanding to arrange forces and resources over time to achieve specified operational objectives. It is the staff's role to recommending the best arrangement of coordinated activities over time in order to solve the problem. Activity 4-6 (frame the timeline) attempts to develop a time sequence to the phasing. Remembering that no plan is optimal and rarely remains as planned, activity 4-7 (frame branches and sequels) provides a tool for the staff to think through the base plan and provide the commander options to deal with changes. Subsystem Two (the "Means" process) is once again updated as the staff performs "what if" analysis with base plans.

INFORMATION TECHNOLOGY LEVERAGE POINTS

The entire "Ways" subsystem provides a leverage point to use graphic displays of the environment, friendly forces, and enemy forces to increase the situational awareness. Providing common operational picture is the primary focus of the information technology thrust grounded in the Force XXI initiative.⁵⁹ A common operational perspective during the planning phase of any operation allows staff cells that may be operating in a distributed arrangement

In a recent exercise at the US Army School for Advanced Military Studies, students were asked to develop a strategic concept for employing a US joint military force between two belligerent countries that had just signed a peace treaty, but needed an honest broker to separate them until the terms of the treaty were met. The staff

progressed through the operational art process and developed a sound plan that in most instances would achieve the specified military objectives. During the briefing of the strategic concept, the commander started to ask what would happen to the base plan if the enemy reacted in a way that had not been anticipated? What would he as the commander do if the unit who was designated to achieve what he considered the key decisive point in destroying the enemy's center of gravity? What would happen if the enemy culminates after one day of fighting? The "what if" questions can be endless, but how is a staff able to think about every possible event? The solution to thinking through options to the base plan is to use a decision support system.

Activity 4-7, framing branches and sequels, provide a rich opportunity for the staff to apply the use of information technology and achieve economy of scale results in time and situational awareness. Decision point tactics is a useful system at the tactical level of war in assisting staffs to think through options and possible new missions in the attempt to never leave their commander without options. Decision support systems also provide a mechanism for framing variations that could occur throughout the entire plan at the operational level of war then uses simulations to wargame results. The US military currently does not own a simulation that accurately simulates the complexity of war at the operational level, but the US Joint research and development community is moving toward developing simulations that could model non-lethal force such as information operations or public opinion as a measure of war.⁶⁰

CHAPTER VIII

CONCLUSIONS

Senge's systems theory and concept of leverage points provided a method of analyzing the complex and fluid process of operational art. This researcher began the research process using a conceptual model that he had developed during the Command and General Staff College Battle Command Training Program graduation exercise. The challenge in thinking about the complexity of solving problems at the operational level of war necessitated developing a model to not only self visualize the process, but to be able to explain the process to others. The standard US Army Military Decision Making Process still had utility, but had shortfalls when attempting to apply it at the operational level of war. The educational process at the US Army School of Advanced Military Studies provided the opportunity to continue to develop and adapt this conceptual model through the introduction and analysis of theory, the study of history, and the practical application of operational art during multiple exercises.

This research set out to answer the question: are there Information Technology leverage points within operational art? The solution is yes there are, but not as many as initially anticipated. Throughout the published works on the concept of decision support technology and the integration of information technology to help people make decisions, a common finding is that the human mind is an amazing tool. Through the use of intuition, mental models, and experience humans are able to sort through reasonable amounts of information to make a decision even with a complex problem. The operable word is reasonable amount of information. Information technology offers multiple mediums that can provide more information than the human mind is able to

process. Today's staff has almost an unlimited amount of information at their disposal to offer to the commander in helping them to make decisions. The tendency in some staffs is to spend a lot of time gathering large amounts of data, but then not spending the time to first decide what is really important and then to synthesize the information into a reasonable amount of information to provide to the commander.

The analysis and presentation of information technology leverage points provide a baseline for additional research and study of the integration of technology to support the process of operational art. At the culmination of this research effort, where to integrate information technology surfaced as the key challenge. The results of this research effort will hopefully benefit military commanders and staff who are required to bridge the gap between strategic goals and objectives and tactical operations in an ever-increasing environment of complexity and time constraints.

ENDNOTES

¹Hubba Wass de Czege, "Thinking About Future War Forum," (1999). BG(R) Wass de Czege led an open group forum (the CGSC non-attribution policy did not apply by his decree) where he used the ASMP class of 99-00 as a sounding board for a project he is working on for the Chief of Staff of the US Army. He is part of an effort working the transformation of the US Army to the Objective Force (2015). "The most difficult thing to automate is people thinking." General Was de Czege further defined using automation as the efficient use of information technology in order to get economies of scale results or savings to reduce manpower requirements. "Principles do not change, methods do."

²The President of the United States of America, *A National Security Strategy for a New Century* [Online Document] (The US White House, December 1999 1998, accessed March 22 2000); available from http://www.dtic.mil/doctrine/jel/other_pubs/nssr99.pdf. "We also are committed to maintaining information superiority – the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting and/or denying an adversary's ability to do the same. Operational readiness, as well as the command and control of forces, relies increasingly on information systems and technology. We must keep pace with rapidly evolving information technology so that we can cultivate and harvest the promise of information superiority among U.S. forces and coalition partners while exploiting the shortfalls in our adversaries' information capabilities. The quality of our men and women in uniform will be the deciding factor in future military operations. We must ensure that we remain the most fully prepared and best trained military force in the world. Accordingly, we will continue to place the highest priority on programs that support recruiting, retention, quality of life, training and education."(pg. 12).

³Peter M. Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization* (New York, NY: Currency-Doubleday, 1990) 205.

⁴Senge, 68-92. Systems thinking teaches that there are two types of complexity: detailed complexity (of many variables) and dynamic complexity (when cause and effect are not close in time). Senge's book primarily focuses on dynamic complexity, but what about detailed complexity? Studies have shown that humans have cognitive limitations. When a person is able to re-train their subconscious break mental models, they are able to better see patterns and trends as opposed to lines and lines of data. " As organizational theorist Charles Kiefer puts it, when this switch is thrown subconsciously, you become a systems thinker ever thereafter."

⁵Tedd A. Wheeler, "Operational & Tactical Exercise Experience," (Fort Leavenworth, KS: US Army Command & General Staff College, 2000). CGSC (98-99): C300 (CTAC) Tactical Decision Making Exercise and Simulation; C500 (DJMO) Joint Operational Exercise; A306 (Initiative Oriented Warfighting) Multiple Tactical Decision Drills and a Tactical Decision Making Exercise and Simulation; A308 (Prairie Warrior-

Digital Division-G3 Planner) BCTP Warfighter. SAMS (99-00) Eight Operational Exercises, including a modified BCTP Warfighter and one Simulation.

⁶Senge, 114-126.

⁷US Department of Defense, *Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms: Operational Art* [Internet Homepage] (Joint Staff, J-7, Joint Doctrine Division Support Group, January 10 2000, accessed March 7 2000); available from http://www.dtic.mil/doctrine/jel/new_pubs/jp1_02.pdf. Operational art helps commanders use resources efficiently and effectively to achieve strategic objectives. It provides a framework to assist commanders in ordering their thoughts when designing campaigns and major operations. Operational art helps commanders understand the conditions for victory before seeking battle, thus avoiding unnecessary battles. Without operational art, war would be a set of disconnected engagements, with relative attrition the only measure of success or failure. (Joint Doctrine Encyclopedia, 1997).

⁸US Department of the Army, *Field Manual 100-5 Content Summary* (Washington, DC: Government Printing Office, 2000) 2:3 & 3:4.

⁹Michael L. McGinnis and George F. Stone, "Decision Support Technology," *Military Review* 74, no. 11 (1994): 68-75.

¹⁰Ronald L. Johnson, "Decision Support Systems for Operational Level Command and Control 1" (Monograph, US Army School for Advanced Military Studies, 1990). Current command and control systems have attempted to provide all of the information a commander (or staff) might need and to push that information into the command post. A good command and control information system must provide the commander with what he needs rather than to flood him with meaningless reports.

¹¹Tedd A. Wheeler, *Operational Art - A Conceptual Model 1* (Fort Leavenworth, KS: Unpublished), Conceptual Diagram. This conceptual model is a work in progress of MAJ Tedd A. Wheeler. The model was initially developed during Prairie Warrior 99 while attending the US Army CGSC (98-99). As a "Digital Division" plans officer I challenged myself to visualize Operational Art as a system. Throughout the PW99 course work and the BCTP, I began to sketch out a diagram that allowed me to visualize Operational Art. Throughout the theory and exercise coursework at SAMS (99-00), I was able to refine my diagram and attempt to better understand the system of Operational Art. The conceptual model uses standard business process diagrams templated in Microsoft Power Point. Appendix I of this research contains a chart index that defines the symbology.

¹²Sun Tzu, "Sun Tzu On War (Chapter V)," in *Art of War* (Bolder, CO: Westview Press, 1994), 375.

¹³Sun Tzu, *Art of War*, trans. Sawyer, Ralph D. Sawyer, Mei-chun Lee (Bolder, CO: Westview Press, 1994) 375. Sun Tzu's eternal dictum of those who know himself, knows the enemy, and knows their terrain will not be endangered in a hundred engagements. Those who fail in either area, increase their chance of failure in a proportionate manner.

¹⁴Carl von Clausewitz, *On War* 1, trans. Howard, M Paret, P (Princeton, NJ: Princeton University Press, 1984)

¹⁵William D. Valentine, "Leveraging Technology: Using the Practical Essence of Operational Art to Translate Information Into Decisions 1" (Research Project, US Naval War College, 1995). It is important to understand that operational art is rooted in the principles of war, and is in fact the tool by which advantages promised by these principles can be translated into operational reality. The principles of war are: objective, offensive, mass, economy of force, maneuver, unity of command, security, surprise, and simplicity.

¹⁶US Department of Defense, *Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms*: Among many considerations, operational art requires commanders to answer the following questions:

- What military (or related political and social) conditions must be produced in the operational area to achieve the strategic goal? (Ends)
- What sequence of actions is most likely to produce that condition? (Ways)
- How should the resources of the joint force be applied to accomplish that sequence of actions? (Means)
- What is the likely cost or risk to the joint force in performing that sequence of actions? (Joint Doctrine Encyclopedia, 1997).

¹⁷US Department of Defense, *Joint Publication 3.0: Doctrine for Joint Operations* [Online US Joint Doctrine] (Joint Staff, J-7, Joint Doctrine Division Support Group, February 1995, accessed March 7 2000); available from http://www.dtic.mil/doctrine/jel/new_pubs/jp3_0.pdf. Facets of Operational Art: Synergy, simultaneity and depth, anticipation, balance, leverage, timing and tempo, operational reach and approach, forces and function, arranging operations, centers of gravity, direct versus indirect, decisive points, culmination, and termination.

¹⁸US Department of Defense, *Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms*. The centers of gravity concept is useful as an analytical tool, while designing campaigns and operations to assist commanders and staffs in analyzing friendly and enemy sources of strength as well as weaknesses and vulnerabilities. Analysis of centers of gravity, both enemy and friendly, is a continuous process throughout an operation. (Joint Pub 3-0).

¹⁹US Department of Defense, *Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms*. There normally will be more decisive

points in an operational area than JFCs can control, destroy, or neutralize with available resources. Accordingly, planners must analyze potential decisive points and determine which points enable eventual attack of the enemy's centers of gravity. The commander designates the most important decisive points as objectives and allocates resources to control, destroy, or neutralize them. (Joint Pub 3-0).

²⁰US Department of Defense, *Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms*. A force operates on interior lines when its operations diverge from a central point and when it is therefore closer to separate enemy forces than the latter are to one another. Interior lines benefit a weaker force by allowing it to shift the main effort laterally more rapidly than the enemy. A force operates on exterior lines when its operations converge on the enemy. Successful operations on exterior lines require a stronger or more mobile force, but offer the opportunity to encircle and annihilate a weaker or less mobile opponent. (Joint Pub 3-0).

²¹US Department of Defense, *Joint Publication 3.0: Doctrine for Joint Operations*. Phasing assists commanders to think through the entire operation and to define requirements in terms of forces, resources, and time. The primary benefit of phasing is that it assists commanders in achieving major objectives, which cannot be attained all at once, by planning manageable subordinate operations to gain progressive advantages, and so achieving the major objectives as quickly and affordably as possible.

²²US Department of Defense, *Joint Publication 3.0: Doctrine for Joint Operations*. No plan of operations can be projected with confidence much beyond the initial stages of the operation. Commanders build flexibility into their plans to preserve freedom of action in rapidly changing conditions. Branches and sequels directly relate to the concept of phasing. Their proper use can add flexibility to a campaign or major operation plan.

²³James J. Schneider, "The Theory of Operational Art" (Theoretical Paper Number 3, US Army Command and General Staff College, 1988). Thus is Operational Art an art or a science? Art comes from an ancient Indo-European root word that means to "put together". The term science comes from the root word, which means to "break apart" or "cut". "Where the artist creates, the scientist analyzes.

²⁴US Department of the Army, *Field Manual 100-5 Concept Papers: Art of Command and Science of Control* [Internet Homepage] (School for Advanced Military Studies Field Manual 100-5 Writing Team, December 1999 2000, accessed March 7 2000); available from http://www.cgsc.army.mil/operations/list_of_papers.htm. Concept Paper #3 - The Operational Framework. This paper asks, "What operational framework will help Army commanders visualize, describe, and direct land operations in the 2000-2006 mission environment?" Concept paper #3 builds a conceptual framework to describe operational art.

²⁵US Department of the Army, *Field Manual 100-5 Concept Papers* [Internet Homepage] (School for Advanced Military Studies Field Manual 100-5 Writing Team, December 1999/2000, accessed March 7 2000); available from http://www.cgsc.army.mil/operations/list_of_papers.htm. Concept Papers:
 #1 The Doctrinal Focus of FM 100-5, Operations. The discussion addresses the doctrinal focus of FM100-5 and the issue of whether the Army should pursue an operations doctrine optimized for offense and defense military actions or a comprehensive approach providing keystone doctrine for a broad range of Army operations.
 #2 The Range of Army Operations This paper recommends that FM 100-5 nest combinations of the comprehensive, Army-specific actions of offense, defense, stability and support (ODSS) within the joint categories of War and MOOTW.
 #3 The Operational Framework. This paper asks, "What operational framework will help Army commanders visualize, describe, and direct land operations in the 2000-2006 mission environment?"
 #4 Visualize, Describe, Direct Methodology This papers builds on current doctrine to propose a disciplined method with which to visualize, describe, and direct operations.
 #5 Balancing Operations, Leadership, and Training Doctrine This papers discusses how the Army should modify training doctrine to maintain balance with doctrine for operations and leadership.

²⁶Ronald L. Schuldt, "Decision Support Tool Bolsters Virtual Enterprise Worldwide," *National Defense* 82, no. 531 (1997): 48-49. The four primary elements of the Commerce at Light Speed (CALS) Virtual Enterprise (VE) model are: information, process, technology, and organization/people.

²⁷Johnson, 5.

²⁸Martin Van Creveld, *Command in War* (Cambridge, MA: Havard University Press, 1985)

²⁹John W. Charlton, "Digitized Chaos: Is Our Military Decision Making Process Ready for the Information Age?" (Monograph, US Army School Command & General Staff College, 1997).

³⁰Charles A. Jr. Bass, "Decision Loops: The Cybernetic Dimension of Battle Command" (Monograph, US Army School for Advanced Military Studies, 1996).

³¹Gary Klein, *Sources of Power: How People Make Decisions* (London, England: The MIT Press, 1999), 24-29. Recognition-Primed Decision Model.

³²Clausewitz, 102. Military genius is a delicate balance between intellect and temperament.

³³Klein, 24-29.

³⁴Senge, 174-204.

³⁵John F. Schmitt, "How We Decide," *Marine Corps Gazette*, no. October 1995 (1995): 16-20.

³⁶US Department of Defense, *Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms*. Tactical level of war: The level of war at which battles and engagements are planned and executed to accomplish military objectives assigned to tactical units or task forces. Activities at this level focus on the ordered arrangement and maneuver of combat elements in relation to each other and to the enemy to achieve combat objectives.

³⁷John F. Antal, "It's Not the Speed of the Computer that Counts! The Case for Rapid Battlefield Decision-Making: The Staff's Role," *Armor* 107, no. 3 (1998): 12-16.

³⁸US Department of Defense, *Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms*. Operational level of war: The level of war at which campaigns and major operations are planned, conducted, and sustained to accomplish strategic objectives within theaters or areas of operations. Activities at this level link tactics and strategy by establishing operational objectives needed to accomplish the strategic objectives, sequencing events to achieve the operational objectives, initiating actions, and applying resources to bring about and sustain these events. These activities imply a broader dimension of time or space than do tactics; they ensure the logistic and administrative support of tactical forces, and provide the means by which tactical successes are exploited to achieve strategic objectives.

³⁹Antal, 2.

⁴⁰Antal, 6.

⁴¹Mark A. Gillott, "Breaking the Mission Planning Bottleneck: A New Paradigm" (Research Report, Air Command and Staff College, Air University, 1998).

⁴²Wheeler, Conceptual Diagram.

⁴³US Department of Defense, *Joint Doctrine Encyclopedia* (Washington, DC: US Government Printing Office, 1997)

⁴⁴Thomas J. Peters and Robert H. Jr. Waterman, *In Search of Excellence: Lessons from America's Best-Run Companies* (New York, NY: Harper & Row, 1982) Eight Characteristics of Excellent American Companies: managing ambiguity and paradox, a bias for action, close to the customer, autonomy and entrepreneurship, productivity through people, hands-on / value driven, sticking to the knitting, simple form / lean staff.

⁴⁵US Department of Defense, *Joint Publication 3.0: Doctrine for Joint Operations*. The desired end state should be clearly described by the NCA before Armed Forces of the United States are committed to an action. An end state is the set of required conditions that achieve the strategic objectives. There may be a preliminary end state--described by a set of military conditions--when military force is no longer the principal means to the strategic aim. There may also be a broader end state that typically involves returning to a state of peace and stability and may include a variety of diplomatic, economic, informational, and military conditions. The relative emphasis among these instruments of national power will vary according to the nature of the crisis.

⁴⁶US Department of Defense, *Joint Publication 3.0: Doctrine for Joint Operations*. Achieving the desired end state seldom, if ever, ends US national efforts to protect interests in a situation. The term "end state" simply represents the set of conditions necessary to resolve a crisis and transition from predominant use of the military instrument of national power to other instruments.

⁴⁷Bill Gates, Nathan Myhrvold, and Peter Rinearson, *The Road Ahead* (New York, NY: Penguin Group, 1995)

⁴⁸Sun Tzu, 65-71.

⁴⁹Senge, 127-135.

⁵⁰US Department of the Army, "Staff Estimates: Appendix C," in *Field Manual 101-5: Staff Organization and Operations* (Washington, DC: Government Printing Office, 1997). Mission analysis, facts and assumptions, and the situation analysis (of the area of operations, area of interest, and enemy, friendly, and support requirements) furnish the structure for the staff estimates. The estimate consists of significant facts, events, and conclusions based on analyzed data. It recommends how to best use available resources. Adequate, rapid decision making and planning hinge on good, timely command and staff estimates. They are the basis for forming viable courses of action. Failure to make estimates can lead to errors and omissions when developing, analyzing, and comparing COAs.

⁵¹US Marine Corps, *MAGTAF Staff Training Program CD* (Quantico, VA:), CD-ROM with Internet links.

⁵²John E. Frame, "Gazing Into the Crystal Ball Together: Wargaming and Visualization for the Commander and Staff" (Monograph, US Army School for Advanced Military Studies, 1996).

⁵³Gordon R. Sullivan, Anthony M. Coroalles, and Army War College (U.S.). Strategic Studies Institute., *The Army in the Information Age* (Carlisle Barracks, PA: Strategic Studies Institute U.S. Army War College, 1995) vi, 22. LoC 95166028

Gordon R. Sullivan, Anthony M. Corrales. "March 31, 1995" Includes bibliographical references (p. 21-22).

⁵⁴Richard C. Whiteley, *The Customer Driven Company: Moving from Talk to Action* (New York, NY: Addison-Wesley Publishing Company, 1991)

⁵⁵US Department of Defense, *Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms*. Military deception--Actions executed to deliberately mislead adversary military decision makers as to friendly military capabilities, intentions, and operations, thereby causing the adversary to take specific actions (or inactions) that will contribute to the accomplishment of the friendly mission.

⁵⁶US Army Corps of Engineers Baltimore District, *Baltimore District Strategic Information Management Plan (SIMP)*, 1st ed. (Baltimore, MD: US Army Corps of Engineers, 1996) 150. CPT Tedd Wheeler was the team leader for authoring and simultaneously gaining buy-in from all key leaders of a district strategic information management plan (SIMP) that would rethink the use of information technology through the next 10 years. The Baltimore District SIMP was successful within the Baltimore District and served as a model within the North Atlantic Division (NAD) and the Corps of Engineers for strategic plans.

⁵⁷BH Liddell Hart, *Strategy* (New York, NY: Penguin Group, 1967) 334-338.

⁵⁸US Department of Defense, *Joint Publication 3.0: Doctrine for Joint Operations*. In modern war, lines of operation attain a three-dimensional aspect and pertain to more than just maneuver. JFCs use them to focus combat power effects toward a desired end. JFCs apply combat power throughout the three dimensions of space and over time in a logical design that integrates the capabilities of the joint force to converge on and defeat enemy centers of gravity.

⁵⁹Kevin B. Leahy, "Can Computers Penetrate the Fog of War?" (Research Project, US Naval War College, 1994).

⁶⁰Karl Perusich, "Understanding and Modeling Information Dominance in Battle Management: Applications of Fuzzy Cognitive Maps," (South Bend, IN: US Air Force Research Laboratory, 1998), 96.

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